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October 10, 2001

Ms. Magalie Salas, Secretary
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Re: ET Docket No. 98-153 – Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmissions Systems
Ex Parte Communication

Dear Ms. Salas,

Intel has closely followed the above proceeding concerning the use of ultra-wideband (UWB) technology.[1] Intel is currently researching this technology in order to evaluate its capabilities for next generation wireless personal area networking (PAN) and local area networking (LAN) based applications.

UWB technology has three significant advantages. First, as has been shown in several comments, UWB's ability to operate in a very large spectrum enables much higher throughputs than current "narrowband" systems, which are limited by practical complexity and cost constraints. Second, this higher throughput utilizes a much lower transmit power than can be theoretically achieved using a narrowband frequency spectrum. This property is well founded in communication and information theory. High throughput combined with low power usage will promote the ubiquitous deployment of the mobile, wireless infrastructure. Third, UWB has excellent position location capability, which will not only enable new applications that are impractical with current narrowband technology, but will also complement many current applications. While designers can choose to optimize traditional narrowband technologies in an attempt to achieve the above benefits, operating with a wider bandwidth could provide the end consumer with more choices, better features, and a lower cost. Therefore, Intel encourages the Federal Communications Commission (FCC) to take the necessary steps in order to allow the industry to develop UWB technology and further explore its potential benefits.

Intel recognizes the concerns of many commenters regarding the potential for UWB devices to interfere with already existing services. UWB technology should share the useable spectrum without causing "harmful" interference to these narrowband systems. As part of our development of the wireless components used in cellular phones and wireless PAN and LAN products in the 2.4 GHz and 5 GHz frequency bands, Intel has investigated the interference potential of UWB on these products.[2] We found that the interference caused by UWB systems would still allow these devices to

[1] "*In the Matter of Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, ET Docket No. 98-153, Notice of Proposed Rule Making ("NPRM") (released May 11, 2000).

[2] Reply comments of Intel Corporation, ET Docket No. 98-153 (filed October 27, 2000).

achieve acceptable performance for their intended operational scenarios, even when a UWB device is located within a 2-3 meter range and transmitting at the proposed NPRM emissions limits.

Intel believes that the UWB industry has persuasively shown that it can coexist with other narrowband systems without causing them harmful interference. With the implementation of reasonable regulations, UWB systems would still yield significant potential for consumers. Many studies have been submitted to the FCC showing the interference potential in the GPS band,[3,4,5,6] the PCS band,[7] and several federal bands.[8] However, the interference potential is reduced when based upon more realistic channel propagation environments, operational scenarios, and coexistence criteria.[9,10,11]

In order to optimize the emissions limits for UWB systems, the FCC will need to balance the interference concerns of narrowband spectrum holders with the potential capabilities of the new technology. The proposal by a large consortium of mostly incumbent spectrum users, which asks the FCC to move the bifurcation boundary up to 6 GHz,[12] lacks adequate technical justification and does not strike a reasonable balance. For instance, the NTIA study of UWB interference on selected federal bands[8] shows that UWB can coexist, using conservative propagation models, with several narrowband systems operating below 6 GHz. Intel plans to build wireless PAN and LAN devices to be used in the 2.4 GHz ISM and 5 GHz U-NII bands, which we found can also coexist with UWB emitters. Moving the UWB emission boundary to 6 GHz could have a significant impact on the commercial potential for this technology as the greater propagation loss experienced at the higher frequency translates into a loss in throughput. For example, the throughput of a UWB system operating between 3 and 5 GHz could be greater by more than a factor of 3 compared to a system operating between 6 and 8 GHz. This factor is very significant for communications based applications. Additionally, the implementation of UWB systems at higher frequencies could significantly increase the overall cost of UWB devices.

The emissions limits proposed by the FCC are a necessary first step for the development of UWB technology to continue. However, wireless coexistence can also be addressed through standards development with industry cooperation, as well as designs targeted for specific applications which take into account coexistence requirements. Indeed, combining the short-range capabilities of UWB with the longer-range capabilities of narrowband systems may yield an effective solution for future wireless networks. Similarly, UWB applications that are targeted for environments where

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[3] *Final Report: Data Collection Campaign for Measuring UWB/GPS Compatibility Effects*, Applied Research Laboratories, The University of Texas at Austin (filed February 27, 2001).

[4] *Final Report: UWB-GPS Compatibility Analysis Project,* Johns Hopkins University Applied Physics Laboratory (filed March 9, 2001).

[5] *Assessment of Compatibility between Ultrawideband (UWB)) Systems and Global Positioning System (GPS) Receivers,* NTIA Special Publication 01-45 (filed March 9, 2001).

[6] *Potential Interference to GPS from UWB Transmitters*, Stanford University (filed by NTIA on March 20, 2001).

[7] *Report of Qualcomm Incorporated*, Qualcomm Incorporated (filed March 5, 2001).

[8] *Assessment of Compatibility Between Ultrawideband Devices and Selected Federal Systems,* NTIA Special Publication 01-43, (filed January 18, 2001).

[9] Reply comments of XtremeSpectrum, Inc., ET Docket No. 98-153 (filed March 12,2001) and *Ex Parte* Presentation of XtremeSpectrum, Inc., ET Docket No. 98-153 (filed June 12, 2001)

[10] Reply comments of Time Domain Corporation, ET Docket No. 98-153 (filed March 12, 2001) and subsequent comments.

[11] Reply of Fantasma Networks, ET Docket No. 98-153 (filed March 12, 2001).

[12] Notice of Air Transport Association of America, Inc. et. al., ET Docket No. 98-153 (filed July 6, 2001).

cellular phones and GPS receivers are common could take additional steps towards reducing this interference. In the end, consumer demands will ensure that UWB devices do not cause noticeable interference to other narrowband systems operating in the same area. Reasonable emission limits for UWB systems could allow uncooperative devices to coexist with other narrowband systems without causing harmful interference, while some flexibility would allow the industry to optimize the UWB system architecture to meet the needs of the targeted applications and the end customer requirements.

Many commenters have also expressed concern about the aggregation of UWB devices in the same area. Intel does not believe that the interference caused by an aggregation of many UWB devices would be noticeable in any realistic deployment scenario and, therefore, should not delay authorization of UWB service. Admittedly, the power of several devices occupying the same spectrum will combine to raise the noise floor of a nearby receiver. However, since propagation loss is proportional to the second or fourth power of distance, depending on the environment, it is reasonable to expect that the closest source of interference will typically dominate the overall interference seen at a device. Many other factors also help to reduce the aggregation of interference from several collocated devices, including discontinuous transmissions for devices supporting packet-based communications, additional signal blockage due to walls and floors, and multiple access techniques that help prevent multiple, collocated UWB devices from causing detrimental "self-interference".

Finally, some compromises were proposed to the FCC by different UWB companies for the purposes of expediting the formation of rules for UWB emissions.[9,13] Intel would support potentially tighter emissions limits than those proposed in the original NPRM, if it could expedite a timely conclusion to this rulemaking process, provided the limits allow sufficient flexibility to foster innovation.

In summary, based upon the extensive record in this proceeding, Intel believes that the FCC can both protect the interests of the incumbent spectrum users as well as authorize UWB service. The detailed technical data that has been submitted to the FCC docket demonstrates that UWB can coexist with other narrowband systems, while expanding the usefulness of wireless devices for the home and office. We urge the FCC to expeditiously adopt regulations for UWB emissions.

Respectfully submitted,

/s/ Kevin Kahn

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cc: Service List

[13] *Ex Parte* Presentation of Multispectral Solutions, Inc., ET Docket No. 98-153 (filed August 31, 2001).

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